

A REVIEW ON THE POSITIVE AND NEGATIVE EFFECTS OF COVID-19 IN THE HUMAN LIFE AND ENVIRONMENT

Ahsan Ullah Khan^{1,2}, Anayat Ullah Khan³, Rana Roy⁴, Minhaz Uddin⁵, Sana Noreen⁶, Sarah Tasnim⁷, Yunita Sari Pane^{8*}

Climate-Smart Agriculture Lab, Department of Agroforestry and Environmental Science, Faculty of Agriculture, Sylhet Agricultural University, Sylhet-3100, Bangladesh¹

Department of Entomology, Faculty of Agriculture, Sylhet Agricultural University, Sylhet-3100, Bangladesh²

Department of Mathematics, Jashore University of Science and Technology, Jashore-7408, Bangladesh³

Department of Agroforestry and Environmental Science at Sylhet Agricultural University, Sylhet, Bangladesh⁴

School of Environmental Science and Engineering, Tianjin University, Tianjin 300072, China⁵
University Institute of Diet and Nutritional Sciences, The University of Lahore, Pakistan⁶

Department of Crop Genetics and Plant Breeding, Institute of Crop Science, Beijing, China⁷

Department of Pharmacology and Therapeutics, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia⁸

Corresponding Author: 8*



Keywords:

COVID-19, lockdown, financial problem, environmental health problems

ABSTRACT

The ongoing COVID-19 epidemic has resulted in new dimensions in the efficacy of the economic and environmental while this virus impacts in human life to create problems in human life. The main objective of this study is to analyze the positive and negative impact on the human and environmental situation of COVID-19 in the world. many research works were done on individual issues for one state of a country but not all state or country data are not available in any sources of the world. To accomplish this goal, preliminary analysis, review articles and reviews released over the past five years have been analyzed with various research data such as NCBI, EMBASE, Google Scholar, PubMed/MEDLINE and MDPI from related clinical trials and animal studies with English terms search: COVID-19, lockdown, financial problem, environmental health problems. The COVID-19 was declination of the GDP, remittance, market policy, private sector credit, tourist industry, employment status, health emergency, shock in education, restrictions in recreation and created pollution like as water, microplastic pollution. The positive effect of covid-19 was the reduction in air and noise pollution, regeneration of biodiversity, and established digital transformation in the world. However, this virus delimited financial sectors have also donated towards a good environment. If COVID-19 and lockdown are released, environmental pollution will increase more in the world. As a result, this research recommends that the policy makers must promote in the financial sector without

disturbing the environmental elements or create a new fund to help the environmental organizations.



This work is licensed under a Creative Commons Attribution Non-Commercial 4.0 International License.

1. Introduction

Coronavirus type 2 (SARS-CoV-2) infection that causes severe acute respiratory syndrome is a Novel Coronavirus Disease (COVID-19), which was first detected in China in December 2019 [59]. It belongs to the family of coronaviridae taxonomic group Sarbecovirus, genus Betacoronavirus, and order Noroviruses. These are gram-positive RNA virus sequences ranging from twenty-six to thirty-two KB, crown-shape ones with a size of 80-160 nM, and next-generation sequencing, and an examination of the biological processes of sequences exposed to COVID- 19 [120]. It was noticeably identical 88% to 2 bat-derived SARS-like coronaviruses, and additional distance from SARS-CoV 79%, and MERS-CoV 50% [76]. It is an infectious pandemic that has recently infected more than two hundred countries in the world. It has unfolded to alternative countries acknowledged as a world pandemic [5], [60].

On January 30, 2020, WHO stated this serious outbreak as a Public Health Emergency of International Concern [118]. Later on, on March 11, WHO proclaimed this unseen, infectious, dangerous virus as pandemic when more cases and deaths were reported [124]. The highly contagious disease has spread to more than 215 countries. In Bangladesh first three cases of COVID-19 were detected on 08th March 2020 (IEDCR, 2020). The COVID-19 is distributed globally, which is not only related to the human health problem but also affects the environment and the world economy in diverse ways. The world economy reduces where the GDP is negative in maximum countries and remittance growth rate is lower than the previous year.

The COVID-19 virus affects the world economy and many studies estimated the impact the worldwide pandemic has on the worldwide economy. The International Monetary Fund (IMF) stated that the virus disease impacts the global economy, and in the middle of April had projected that the global economy will contract by 3% in 2020 [119]. But in June 2020, IMF reported that the growth at -4.9%, which was 1.9% points lower than the April forecast. according to the IMF, in June 2021, the global growth was projected at 5.4% where the gross domestic product (GDP) was about 6.5% points lower than in the pre-COVID-19 estimates of January 2020. The remittance is the second-highest earning source after the garments sector in Bangladesh. The remittance is influencing the GDP of Bangladesh. In 2019, the remittance was recorded at \$18.32 billion [10]. It covers up about 6-8% of the country's GDP and reduces a generous influence on macroeconomic stability, poverty reduction, and also in national income. It is a safety valve for lots of Bangladeshi migrant employees and their families. In 2020-2021, the GDP of India was lowest after the year 1991-1992 [29]. In early March 2020, the world GDP loss was -0.8% whereas the negative GDP was also found in China, the US, France, Germany, and Russia [82].

Although the COVID-19 is new, the old problems have become apparent at this time. Again, many positive aspects have been created. Although the economic situation in the world was deteriorating, its impact on the environment was normal. Many studies said that the excess elements of the environment are greatly reduced due to lockdown and COVID-19. The covid-19 created new problems also such as unemployed situation, water and plastic pollution, educational problem, restrictions in recreation, tourism industry, health

emergency, financial problem, fall in GDP and remittance, share market fall, and so on. The positive is improving the air elements, reduction in noise pollution, regeneration of biodiversity, improving the digital transformation, and so on. In many countries, coronaviruses are being recorded every day as the number of infections and deaths. Corona has become even more deadly by developing new stains. On the 3rd August 2021, the COVID-19 cases recovered and death is (199664421, 180141680, and 4250338) in the world [127]. Considering the above fact, this study focuses on the positive and negative impacts of COVID-19 from an economic and environmental perspective around the globe.

2. THE NEGATIVE IMPACT OF COVID-19 IN THE WORLD

2.1 Fall of GDP of the world

The virus disease of COVID-19 is spread internationally. Many countries of the world have already taken or will ultimately act to boundary the spread, through social separation policies, such as restricting educational institutions, warning work, and limiting the mobility of people. The defensive actions have had an instant and significant impression on all economies. In Bangladesh, the prominent economic sectors are Agriculture, Industry, and service sectors which contributed (18, 29, and 53)%; respectively to the Indian gross domestic product (GDP) of the country are badly impacted by the COVID-19 epidemic [14]. The Asian Development Bank forecasts that Bangladesh will lose unevenly \$3 billion in its GDP concurrently work cuts for about 9 million individuals. In specific sector circumstances, the most noteworthy GDP misfortune and service cuts will be good to go division counting cash linked area, exchange and open managements (\$1.14 billion) followed by the travel industry (\$510 million), development and utilities (\$400 million), agribusiness (\$637 million), and transport administration (\$334 million) [1], [13]. Henceforth the COVID-19 and lockdown had a direct impact on the agriculture, industrial and service sectors of Bangladesh. In the first 11 months of 2020, the total export value was \$30,295.52 million, 15.40% less than \$35,812.27 million in 2019 (Bangladesh Bank, 2020a). The COVID-19 virus and lockdown were had a 4% permanent loss to real GDP. In 2020-2021, the GDP of India was 1.9% and it will be the lowest after India noted a growing rate at 1.1% in 1991-92 [29]. In early March 2020, the world GDP loss was -0.8% where the negative GDP was also found in China, the US, France, Germany, and Russia (-1.5, -0.2, -1.3, -1.2, and -0.9) %; respectively [82]. This study also indicated that the only the GDP increase in Japan, 01% in 2020. From Figure 1 the mean annual growth rate (%) of the world GDP was (2.5172), Australia (2.7034), Bangladesh (6.0096), Brazil (2.0058), Canada (2.1725), China (8.7050), Germany (0.9585), France (0.8183), United Kingdom (1.1312), Indonesia (4.9112), India (5.8827), Malaysia (4.0633), Pakistan (1.7247), and United States of America (2.5172) during 2001-2020. The Covid-19 and lockdown have a direct effect on GDP and secondary impact on the social system, and human life. [104] stated that the US GDP will stagnate where the China GDP will fall. Due to strict lockdown, reduction in orders from industrialized/developed countries, shipping limits, etc. destructively exaggerated the country's exports.

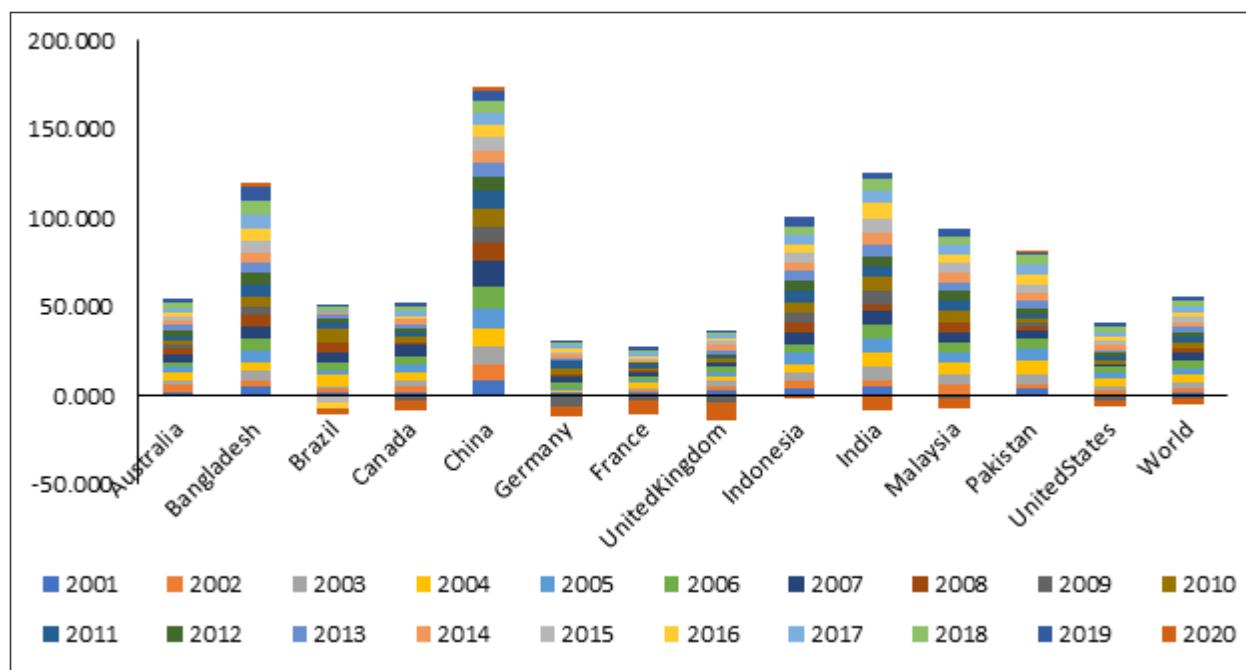
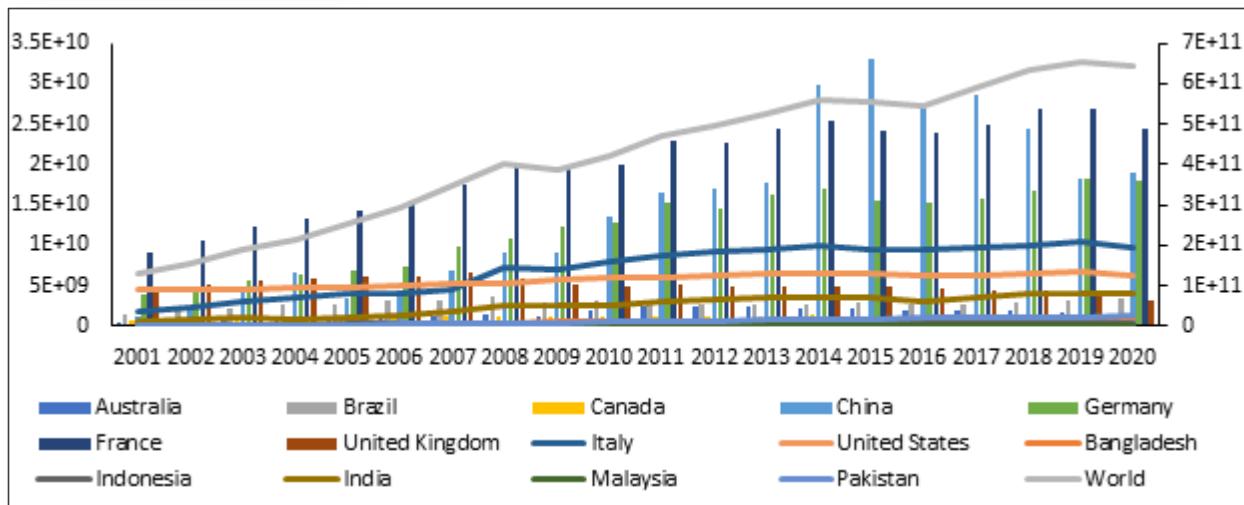


Figure 1. The annual growth of GDP flow in the world from 2001 to 2020

Source: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=BD>

2.2 Declination of remittance growth in the world

The recent literature has revealed that developing countries have good opportunities and security in the remittance sector [131]. This sector has been a lifeline for many developing countries in the world. But the COVID-19 and lockdown have an impact and flow on international remittance of the world. Bangladesh received 21.75 billion US dollars from deportees in 2019 which was increased 18.4% of GDP and in 2020, Bangladesh is the eighth largest remittance earner 21749701161 which was increased 6.6% GDP according to the Global Knowledge Partnership on Migration and Development (KNOMAD). Among the eight South Asian countries, Bangladesh received remittances of US\$20 billion and ranks as the third-largest followed by India (US\$75.9 billion) and Pakistan (US\$24.1 billion) in 2020 [122]. World Bank specified that the general migrant workers' remittance from Bangladesh would decay to \$14 billion by 2021 which will about 25% fall from the previous year [123]. In 2019, India was the largest in remittance (83,131 million US dollars, 2.8 percent of GDP), and China (68,398 million US dollars, 0.5 percent of GDP) [17]. [44] stated that after the announcement of lockdown the remittance reduction in 63% in India and 2020 fell the remittance by 0.2%. In Pakistan, the remittance was increased by 17% in 2020 whereas China is the second-largest remittance gainer in 2020. From Figure 2, the mean of the world remittance was (\$423401200000), Australia (\$1551311192.2350), Bangladesh (\$10572532268.8500), Brazil (\$2848885738.3500), Canada (\$1107902355.9050), China (\$14640042250.3), Germany (\$12199508270.25), France (\$19945758256.8), United Kingdom (\$5115213895.9000), Indonesia (\$6693459538.4000), India (\$51383308546.6000), Malaysia (\$1247953030.0950), Pakistan (\$12022300000), and United States of America (\$5746200000) during 2001-2020. The Covid-19 and lockdown have directly affected GDP and secondary impact on the social system, and human life.

**Figure 2.** The remittance flow in the world from 2001 to 2020

Source: <https://data.worldbank.org/indicator/BX.TRF.PWKR.CD.DT?locations=BD>

2.3 Fall of market policy

COVID-19 is the most contrary armistice shock wave to the global budget in a century [121]. The COVID-19 has seen an unparalleled crisis in the form of coronavirus and has affected the global economy. The market is usually the place of all kinds of financial transactions, although the market in the village is considered to be the market for daily necessities. Corona Kalin has had an impact on the market system in the lockdown. Small traders are in trouble. As a result of the lockdown, both sides are suffering. Not only are its effects on market shakiness the largest in the past of pandemics [9], Costa Junior et al., 2021), but numerous hesitation dials have reached their maximum values on record [7], [9], [97]. The COVID-19 and lockdown not only affect the general market but also affect the stock market [8], [94]. [33] stated the economic impact of the COVID-19 crisis was shown in the early investigation in China, exposing that small and medium-sized trades had severely been affected. It is also affected on the Japanese labor market vary across people of different age groups, genders, employment types, education levels, occupations, and industries [70]. [4] reported that the COVID-19 has significant losses in terms of employment, working hours, and labor income 2020. This study also noted that in retort to COVID- 19 crisis, the government of Bangladesh and the Bangladesh Bank provided inclusive care to the labor force across all financial sectors, including agriculture, industry, SMEs, and services. This crisis was sharply declined in the consumption level of humans in the world.

2.4 Decelerating private sector credit growth

The COVID-19 and lockdown have a bad effect on the private companies of the world. The ILO's initial valuation of the impact of COVID-19 on exact social and financial sectors and industries is seized in a series of sectoral mandates. It is a very challenging issue for managing private companies. The governments, employers, and workers were faced financial problems in their industries. The COVID-19 and lockdown have an impact on the different organizations of the world like as the post sector, meat processing sector, construction sector, workers proving home, urban passenger transport service, public emergency service, automotive industry, textiles, clothing, leather, and footwear industries, education sector, tourism sector, garments industries, agriculture and food security [61], forest sector, food retail, maritime shipping and fishing [62], hotel industry [132], hand hygiene at the workplace, the health sector [65], Out et al., 2021) and so on. These virus diseases have been effective for a long-time hotel [99], [115]. Such private and government organizations reduction their financial environment of the world and now it is too much dangerous in human life.

2.5 Fall of the tourist industry

Traveling is the most enjoyable way to meet energetic and travel to new places if the way is free of crime, disease, and calamities. The tourism business was one of the supreme markets in the world; until the world met a disease COVID-19 last December 2019. The fast epidemic of COVID-19 not only exaggerated the worldwide budget on an enormous scale but also challenged social life. The rapid spread of the virus was modified which was an impact on tourism sectors in the world. It has formed a significant effect with international travel bans affecting over 90% of people of the world and widespread limits on public gatherings, community mobility, and tourism mainly comes to a stop in 2020 (Horaira, 2021). After the second world war, the world's global tourism growth has been negative [96]. This study also noted that the global tourist flow was decreased by 58% in 2020 and 77 % decreased average revenues in 2019 [6]. According to the World Tourism Organization (UNWTO), Chinese tourists paid the alike of \$277 billion abroad in 2018; it is proclaimed to be 21% of worldwide travel expenditure [113]. The tourism income reported for about 11% of GDP in 2018; ten years ago, it was only 6% in Thailand (TEO, 2021). The UNWTO stated that the international tourist flow was decreased (60-80%) in 2020 associated with 2019. Tourism incomes around the world were reduced by 600-900 billion US dollars in 2020 [112]. Hotel is a very important element for developing a tourism place but this sector is stressed to continue to the extent that 35% of hotels had to cease their operation temporarily. Dw (2020) noted that the tourism businesses will be lost about 60% and 15% of the hotel operators will completely close their operation in Malaysian.

2.6 Evolving unemployment problem

Near-term forecasts are most challenging but also most important when the economy experiences an abrupt change. COVID-19 shutdown effect of the global economy [86]. During this COVID-19 and lockdown crisis, huge unemployment has become the major feature of work, with millions of persons and relatives now troupe into a world of uncertainty and precariousness [51]. Because work is associated with existence in many societies, the loss of service chances represents a basis of existential fear which balances and composites the intense worries about sore and untimely death. Without entree to the cash and health protection that many jobs provide, persons in nations like the USA are left in a state of intense fear about how they will endure. While a recent brew of support has been approved in a USA central government relief package, the truth of this funding is that it is fleeting and not justifiable for most who are deprived of work. Moreover, the fast onset of joblessness has helped to reveal the rising disparity that exists in many Western societies [106]. The laborers who have been pretentious by joblessness tend to be those who have had risky jobs in facilities, restaurants, transport, and other fields that characteristically do not offer long-term agreements, dressed wages, and health aids [52]. Rising rates of unemployment also contribute to increasing behavioral health disorders [85], leading to more suffering and deaths (Case and Deaton, 2020). The suicide rate is higher in unemployed people. COVID-19 related unemployment may significantly increase suicide rates, implementation of appropriate preventative measures is critical [31].

In May 2020, 2.3 million Australians either were unemployed or had work hours reduced for economic reasons, resulting in the steepest rise in rates of unemployment on record a change from 5.2% (March) to 7.1% 2, with Treasury predicting a rate of 8% by September [31]. In a study by Bauer and Weber (2020), the authors examined the real impact of anti-pandemic measures on unemployment in Germany. They used the difference-in-differences method where they compared the development of inflows to unemployment and quantified the 60% increase in unemployment due to the shutdown measures. The shutdown measures increased unemployment in the short run by 117,000 persons. In October 2020, the unemployment rate in Slovakia reached the level of 8.2% and the number of jobseekers was 222,242 compared to 168,757 jobseekers in January of the same year [105]. The Global Financial Crisis (GFC), which led to the deepest recession since the 1930s and the loss of 30 million jobs worldwide, is estimated to have resulted in at least

10,000 additional economic suicides between 2008 and 2010 in Europe and North America [90]. Projections using historical data suggest suicide rates may increase by 3.3–8.4% over the 2020–2021 period in the US [77], and up to 27% in Canada [78]. In the setting of the COVID-19 and lockdown crisis, however, the pathological danger is imperceptible, inserting people into a reliable state of horror that becomes extra difficult to lessen.

2.7 Water pollution

Water is one of the very important natural resources which is an effect on life-supportive mechanisms of the environment and it springs energy to all biotic and abiotic elements of the ecosphere. It has been fervently polluted by various human activities like industrialization, agricultural practice, urbanization, and over misuse in normal times. During the lockdown period, [45] studied that the pollution level of the aquatic environment has been strangely released because of no mingling of industrial wastewater, solid waste, heavy metals, etc. [84] stated that the COVID-19 was traces in wastewater and the practice of sterilizing outdoor spaces in numerous metropolises in the world, which can result in the entrance of sanitizers and their byproducts into storm drainage schemes and their ensuing release into rivers and coastal waters, increase the issue of environmental, ecological and public health effects. The occurrence of COVID-19 has been noticed in untreated wastewater in the Netherlands [75], [79], Australia [3], and the USA [130]. COVID-19 can be found in rivers in India at the rate at which corona dead bodies were found. An increasing doubt hence occurs on how water hardness and managing in several countries can address the challenges of the COVID-19 epidemic since COVID-19 has changed water drinking patterns and also made the effects of drought and constant water lacks more acute in countries like Ireland, the UK, Turkey, Poland, Romania, Kosovo, Ethiopia, Kenya, India, Syria, and so on already suffering from climate variation and continuous decline in rainfall patterns [110], [53], [102], [26], [15].

2.8 Microplastic pollution

Plastic has been carrying a lot of weight in human life for ages. But it has moved not only on the positive side but also on the negative side. The new revolution that began with the discovery of plastics in 1845 is harming the environment today. It is contributing to great advances in health through food safety and disposable medical equipment. It is one of the most motivating topics of transboundary amount with lots of plastic substances of manifold sizes, from nano to macro, being cleared into the rivers and seas daily [40]. The intimidations that plastic pollution stances to nautical environments have been considered for a long time and are well soundless [16], [69]. Their use in treatment as disposables is allowable to decrease the risk of the transmission of blood-borne pathogens as well as decrease costs with material dusting and purification [71]. Plastics now have a crowd of applications, with global manufacture attainment of 359 million tons in 2018 [39]. However, unselective use and waste mishandling have led to the common environmental pollution of plastics. Over 5 trillion plastic parts are flooded in the world's oceans [38], with a projected annual influence from plastic waste elated by rivers of 1.2-2.4 million tons [72]. The persistence, irreversibility, and ubiquity of plastics in the environment, as well as possible effects on environmental societies and bio-network operative, have led to their description as a planetary boundary threat [114]. The global mask production rate has seen tremendous growth and will continue to rise in the upcoming years. The medical wastes are syringes, latex gloves, face shields, surgical and face masks, apron, shoe covers, surgical and isolation gowns, PPE, etc. during the COVID-19 pandemic in the hospital and home (Figure 3). As an example, globally, China is the major producer of global face masks. Face mask production in China increased to 116 million per day in February 2020, 12 times higher than usual [2]. The global face mask market's value rose from 0.79 billion USD in 2019 to approximately 166 billion USD in 2020 [87]. A yearly calculated plastic waste group in Bangladesh was plastic surplus from N95 (25,709.9 ton), SM (42,205 ton), total plastic surplus (67,996 ton), mismanaged surplus (65,786.13 ton), debris upper

estimation (26314.45 ton), lower estimation (9867.91 ton) input into oceans from face masks [22]. Inadequate supervision of only 1% of face masks may contribute to a surplus of 30,000–40,000 kg per day [126]. Polymers having high concentrations like polyvinyl alcohol, polyester, and polyvinyl chloride may end up at the bottommost of the sea [32], [42].



Figure 3. Medical wastes originated during the COVID-19 pandemic



Figure 4. Photographs of surgical face masks polluting the streets and beaches [107]

2.9 Health emergency

COVID-19 is the current crisis for the common factor of human hygiene in the world. The human COVID-19 virus disease was early documentation in Wuhan, China in December 2019 [66]. It was declared a global epidemic on March 11, 2020 [63]. The most common symptoms of COVID-19 are fever, cough, headache, sore throat, and fatigue, sputum production, dyspnea, diarrhea, hemoptysis, and lymphopenia [48]. The COVID-19 virus can lead to respiratory failure, cardiac injury, distress syndrome, acute respiratory and even death [54]. This virus disease has affected more than 215 territories and countries of COVID-19 around the world on 20 May 2020. The infestation and mortality rate increasing day by day [67]. In September 2020, over 36 million people have been infected by the COVID-19 were over 1 million deaths [128]. By the end of 2020, more than 80.3 million tests and 1.77 million deaths had been stated worldwide [35]. In March 2021, the plague has quickly swept across the globe contaminating more than 122 million people, and more than 2.69 million people died (JHUSM, 2021, [129]). In Bangladesh first three cases of COVID-19 were detected on 08th March 2020 (IEDCR, 2020). It touched 100 cases on 9 April 2020 and exceeded 200 cases (Case Doubling Time) within the next two days. As of October 12, 2020, there were 379,738 confirmed cases including 5,555 deaths with the case fatality and recovery rate 1.85% and 77.5%; respectively in Bangladesh [125]. The pandemic has rapidly swept across Bangladesh infecting more than 962 thousand people, recovering more than 475 thousand people, and more than 8 thousand people died [64].

Since December 2019, COVID-19 has spread rapidly from Wuhan, China, around the world [68]. The preventive actions for minimizing the COVID-19 virus infestation in the human being and the requirements are community health education, medical properties distribution, heightened case documentation, quarantine (high-risk group quarantine), restriction of the visit other countries, public place, and restriction of patient visitors in hospitals [47], [117]. The use of the marks, hand gloves, and hand sanitizer reduces the spread of the COVID-19 [73]. These actions increased the use of medical gloves, face masks, and gowns in healthcare structures and among the public [56]. The hands, eyes, nose, and mouth are the very common truck for micro-pathogens, and hand washing is dynamic in stopping this virus, which is an important habit in home and hospital [74].

2.10 Shock in education

The covid-19 impact of the pandemic has a sure influence on various walks of life around the world. the covid-19 has been changed a lot in the social life of the global. To keep the community distance between human beings to avoid being infected is the most significant plan for all the countries. Many schools, colleges, and universities have been locked down to minimize the spread out of this coronavirus infection [20]. Even though the geographic distance among different countries converts smaller due to the feast out of this coronavirus, the social distance between human beings should be enlarged to avoid being infested [57], [21]. UNESCO estimated that more than 1.5 billion students and 63 million educators are exaggerated by school closures in 188 countries in 2020 [111]. Due to doubt on schedules, applications for most graduate plans are delayed to a specific time or irrecoverable around the world [81]. It has created significant challenges for the global advanced education community [27]. Learning methods should be invented to keep on the education process but away from being infested for education during the pandemic. The best way to facilitate school, college, and university teaching in lockdown is to take online classes. Educational institutions have been closed in Bangladesh since the beginning of 2020, and so 3rd or 4th-year examinations have not been held. This has caused frustration among the students. Although thousands of institutions continue their activities in the world, it is not possible to take the examination for this year. The

online class is the face-to-face teaching best system to manage the social distance among the students which straight disturbs the quality of education [108]. Students could not manage classes online or they do not have an electric device in the poor family. Again, many live in remote villages, so there are no internet facilities. Many students are dealing with a busy life in the name of video games. Many are in class but cheating with respected teachers. Google met or zoom is a good online system, but students are using it differently. The government was followed the auto pass system for Higher Secondary Certificate level students in 2020 in Bangladesh. At the end of 2021, SSC and HSC Level students will be tested on three subjects in Bangladesh.

2.11 Restrictions in recreation

Because of COVID-19 and Lockdown, the young people wanted to do something new as entertainment, which resulted in Frank and Funny short videos. Where many people want to highlight the problems of society which are expressed through jokes. School, college, university, and medical students have also done business through funny videos, different types of dances, and songs on social media. Again, many have made money with the delivery of various meals in the home to solve financial problems. In the lockdown condition, people change some permanent desk behavior routines, like as lying down, sitting, watching TV, playing games for a long time, or always being devoted to the awning with mobile policies; a decline in the level of physical activity eventually increases the risk possible for chronic fitness situations [19]. The young adult population is sitting more than three hours during COVID-19 compared to before the lockdown [91], [95]. The younger show less movement and augmented sitting behaviors while expenditure more time inside [24], [80], [89]. Generally, the lockdown is observed only in cities, not in rural areas. So, the children of the village play different types of games that they used to play, but the number of the games or players would be less. For example, playing football on a rainy day is a very common game in the village but now no parents ever allow their child to play in the rain because there is only one reason if they are infested as a cough which is a common symptom of COVID-19. At this time some online video games have been developed that many of our young people like. Newspapers have reported that many people have died for this video game, just as many people have died while making funny videos.

3. THE POSITIVE IMPACT OF COVID-19 IN THE WORLD

3.1 Reduction in air pollution

The WHO approximations that about 91% of the world's people are unprotected to poor air quality and that 4.2 million persons die each year from causes straight accredited to air pollution (WHO, 2020). [43] evaluate that the study observed the air pollution in the countries of China, USA, France, Italy, India, UK, Spain, and Other countries of the world. The findings are the COVID-19 and the lockdown improve the air quality. Several recent studies have taken about the air pollution in the world. Recently, those researches were focused on the change in air quality and connection of air elements. Such studies were conducted in the cities of 44 cities in China [11], Almaty (Kazakhstan) [58], Barcelona (Spain) [109], Milan (Italy) [23], Stockholm, Sweden [93], Rio de Janeiro (Brazil) [98], to know about the NO₂ levels [23], CO levels [28], Particulate Matter [23], etc. in the air during COVID-19 session. Those studies were confirmed that the signs of progress of the air quality [92], and the average reduction of 7.8% of the air pollutants (i.e. SO₂, Particulate Matter, NO₂, and CO) [41]. The burning and dumping of the waste plastic affect the air quality which is used for minimizing the COVID-19 in the world. The plastic waste released significant amounts of CO₂ and CH₄ which were effective on the air quality [88].

3.2 Reduction in noise pollution

Amongst all pollutants, noise pollution is the third most dangerous pollutant after air and water pollution in

the world. Noise pollution is very evident in urban cities and is generally evaluated that the sound level comes from different human activities (e.g., factories, machines, vehicles, construction work, etc.) that are effective in human and living organisms [133]. Moreover, due to the lockdown, the number of industrial works stop, public transports, and flights movements have radically reduced in the world, which has eventually decreased the noise pollution during the COVID-19 pandemic period. [100] stated that passenger air travel has been decreased more than 90%, car traffic has dropped less than 50% and trains are running more than 25% in Germany than the normal tolls. In Delhi (India), noise pollution was drastically reduced by about (40-50) % during the lockdown session [103]. For this, the COVID-19 lockdown and declines in financial activities decreased the noise pollution in the world.

3.3 Regeneration of biodiversity

The COVID-19 pandemic and lockdown are effects on the economy and society which have produced some benefits and risks to biodiversity in the world. Ecological studies considered to relate the state of biodiversity before and after COVID-19 conjectured to disturb its qualities must normalize sampling for both periods. Only then may alterations in outcomes be attributable to the COVID-19 of interest. When the COVID-19 epidemic and lockdown started, research scholars retorted by scheming studies to describe biodiversity comebacks to changes in human behavior [12]. Weather and climate are the most important elements of the biodiversity of the world whereas climate change is a key feature of biodiversity loss and the loss of species has harmful effects on the weather. Climate change has impaired the increase in the amount of concentration CO₂, O₂, N₂, CO, SO₂, etc., and top to additional biodiversity loss (ECQA, 2020). The ecological studies stated that the biodiversity of the agriculture, freshwater fish, socio-economy-welfare, and environmental sciences are improved during the COVID-19 period [30], [25].

3.4 Digital transformation

Digital transformation is the method of using digital technologies to generate new or adjust current business procedures, customer, and cultural knowledge to meet altering business and market necessities. In this transformation needs of teleworking, telecommuting, working at home, working from home, virtual work, working remotely, mobile work, e-work, e-commuting, flexible workplace, and freelancing have all been used to designate the current styles of work and to jump-start digital transformation of the staff. It is based on the digital supply network system [101]. It is created a new system for sales, marketing, and customer service. COVID-19 affects all the sectors of economic, agriculture, industries, private and government organization but the digital transformation system is ongoing during the COVID-19 pick period [36]. Using digital transformation, people would come to take the necessary things in this lockdown by maintaining social distance. In which there was medicine, daily necessities, curry, and many more where all that was needed was just a phone call. However, some extra money was indeed spent. The COVID-19 disaster is likely to wipe out 10.5% of working times worldwide in the second quarter of 2020 equal to 305 million full-time laborers with large decreases predicted for Asian financial prudence [51].

4. Conclusions and Recommendations

COVID-19 and lockdown have played an important role in the stability of the environment and significant wave the economic condition which has reshaped old problems as new like an unemployed and educational problem, water, and microplastic pollution in the world. The positive side of covid-19 was the reduction in air and noise pollution, regeneration of biodiversity, and established digital transformation. The environmental condition is not permanent but it may change after release the lockdown in the world.

Author Contributions: This work was conducted in collaboration with all authors. Author AUK and AUK were planned, structured, wrote, revised, and rechecked the manuscript thoroughly. SN, ST, and YSP

improved the draft copy. RR and MU were contributed to revise and improve the manuscript thoroughly. All authors reviewed carefully and approved the final version of the manuscript.

5. References

- [1] ADP (Asian Development Bank). Coronavirus stands to wipe \$3b off Bangladesh's economy. Finds an ADB analysis; 2020. Available online at: <https://www.thedailystar.net/business/news/coronavirus-stands-wipe-3b-Bangladesh-economy-1877950>.
- [2] Adyen, T.M., 2020. Accumulation of plastic waste during COVID-19. *Science* 369 (6509), 1314–1315. <https://doi.org/10.1126/science.abd 9925>.
- [3] Ahmed W, Angel N, Edson J et al. (2020) First confirmed detection of SARS-CoV-2 in untreated wastewater in Australia: a proof of concept for the wastewater surveillance of COVID-19 in the community. *Science of the Total Environment* 728: 138764. <https://doi.org/10.1016/j.scitotenv.2020.138764>.
- [4] Al Mamun MS, Ahmed R, and Islam ME. 2020. Labour Market Dynamics in Bangladesh: Impact of the COVID-19. Policy Note. PN 2104: 1-11.
- [5] Alanagreh L., Alzoughool F., and Atom M. "The Human Coronavirus Disease COVID-19 : Its Origin, Characteristics, and Insights into Potential". *Pathogens*, Vol. 9, p. 331, 2020. Available from: doi.org/10.3390/pathogens9050331.
- [6] Almaashani MS. 2021. The Impact Of COVID-19 On The Tourism Sector In Dhofar Submitted In Partial Fulfillment Of The Requirements For The Degree Of Name : Mohammed Said Taman Al Maashani. The German University of Technology in Oman: 1-70.
- [7] Altig, D., Baker, S. R., Barrero, J. M., Bloom, N., Bunn, P., Chen, S., Davis, S. J., Leather, J., Meyer, B. H., Mihaylov, E., Mizen, P., Parker, N. B., Renault, T., Smietanka, P., and Thwaites, G. (2020). Economic uncertainty before and during the COVID-19 pandemic. *Journal of Public Economics*, 191:104274.
- [8] Ashraf, B. N. (2020). Stock markets' reaction to COVID-19: Cases or fatalities? *Research in International Business and Finance*, 54:101249.
- [9] Baker, S. R., Bloom, N., Davis, S. J., Kost, K., Sammon, M., and Viratyosin, T. (2020). The unprecedeted stock market reaction to COVID-19. *The Review of Asset Pricing Studies*, forthcoming.
- [10] Bangladesh Bank. 2020. Bangladesh Bank Quarterly. <https://www.bb.org.bd/pub/quaterly/bbquarterly/july-sept2020/bbquarterly.php>
- [11] Bao, R., and Zhang, A. (2020). Does lockdown reduce air pollution? evidence from 44 cities in northern China. *Science of the Total Environment*, 139052.
- [12] Bates, A.E., Primack, R.B., Moraga, P., Duarte, C.M., 2020. COVID-19 pandemic and associated lockdown as a “Global Human Confinement Experiment” to investigate biodiversity conservation. *Biol. Conserv.* 248, 108665. <https://doi.org/10.1016/j.biocon.2020.108665>.

[13] Begum M, Farid MS, Alam MJ, and Barua S. 2020. COVID-19 and Bangladesh: Socio-Economic Analysis towards the Future Correspondence. Asian Journal of Agricultural Extension, Economics, and Sociology. 38(9): 143-155, 2020. Doi: 10.9734/AJAEES/2020/v38i930417

[14] BER (Bangladesh Economic Review). Dhaka, Bangladesh; 2019.

[15] Bhowmick, N., 2020. India confronts COVID-19 with scarce running water. National Geo- graphic Coronavirus Coverage. Available from: <https://www.nationalgeographic.com/science/2020/04/hand-washing-can-combat-coronavirus-but-can-the-rural-poor-afford-frequent-rinses/> (Accessed 5 July 2020).

[16] Browne, M.A., Crump, P., Niven, S.J., Teuten, E., Tonkin, A., Galloway, T., Thompson, R., 2011. Accumulation of microplastic on shorelines worldwide: sources and sinks. Environ. Sci. Technol. 45, 9175–9179. <https://doi.org/10.1021/es201811s>.

[17] BSP. Bangko Sentral ng Pilipinas. 2020. [n.d.] Statistics External Accounts, Overseas Filipinos' Remittances. Available from: <https://www.bsp.gov.ph/statistics/external/ofw.aspx>. Accessed July 2021.

[18] Case, A., and Deaton, A. (2020). Deaths of despair and the future of capitalism. Princeton University. [HTTPS:// doi.org/10.2307/j.ctvpr7rb2](https://doi.org/10.2307/j.ctvpr7rb2).

[19] CDC. Center for Disease Control and Prevention. (2020). Coronavirus 2019 (COVID-19) Stress and coping. Accessed 04 April 2020. Available at <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html>.

[20] Chang T, Hong G, Paganelli C, Phantumvanit P, Chang W, Yi Shieh, Hsu M. Innovation of dental education during COVID-19 pandemic. Journal of Dental Sciences (2021) 16, 15e20. <https://doi.org/10.1016/j.jds.2020.07.011>

[21] Chen J. Pathogenicity and transmissibility of 2019-nCoVda quick overview and comparison with other emerging viruses. Microb Infect 2020; 22:69e71.

[22] Chowdhury H, Chowdhury T, Sait SM. (2021). Estimating marine plastic pollution from COVID-19 face masks in coastal regions. Marine Pollution Bulletin. 168(112419):1-7. <https://doi.org/10.1016/j.marpolbul.2021.112419>.

[23] Collivignarelli, M. C., Abb`a, A., Bertanza, G., Pedrazzani, R., Ricciardi, P., and Miino, M. C. (2020). Lockdown for covid-2019 in Milan: What are the effects on air quality? Science of The Total Environment, 732, 139280.

[24] Constandt, B., Thibaut, E., De Bosscher, V., Scheerder, J., Ricour, M., and Willem, A. (2020). Exercising in Times of Lockdown: An Analysis of the Impact of COVID-19 on Levels and Patterns of Exercise among Adults in Belgium. International Journal of Environmental Research and Public Health, 17(11), 4144. <https://doi.org/http://dx.doi.org/10.3390/ijerph17114144>

[25] Cooke SJ, Twardek WM, Lynch AJ, Cowx IG, Olden JD, Smith S, Lorenzen K, Arlinghaus R, Chen Y, Weyl OLF, Nyboer EA, Pompeum PS, SM Carlson, JD Koehn, AC Pinder, R Raghavan, S Phang, AA Koning, WW Taylor, D Bartley, R Britton. A global perspective on the influence of the COVID-19

pandemic on freshwater fish biodiversity. Biological Conservation 253 (2021) 108932. <https://doi.org/10.1016/j.biocon.2020.108932>.

[26] Cotterill, S., Bunney, S., Lawson, E., Chisholm, A., Farmani, R., Melville-Shreeve, P., Oct. 2020. COVID-19 and the water sector: understanding impact, preparedness and resilience in the UK through a sector-wide survey. Water Environ. J. wej.12649.

[27] Crawford J, Kerryn Butler-Henderson, Jürgen Rudolph, Bashar Malkawi, Matt Glowatz, Rob Burton, Paola A. Magni, Sophia Lam. 2020. COVID-19: 20 countries' higher education intra-period digital pedagogy responses. Journal of Applied Learning and Teaching. 3(1):9-28. Doi: <https://doi.org/10.37074/jalt.2020.3.1.7>

[28] Dantas, G., Siciliano, B., França, B. B., da Silva, C. M., and Arbillal, G. (2020). The impact of covid-19 partial lockdown on the air quality of the city of Rio de Janeiro, Brazil. Science of the Total Environment, 729, 139085.

[29] Das KK and Patnaik S. 2020. The Impact of COVID-19 in Indian Economy – An Empirical Study. International Journal of Electrical Engineering and Technology, 11(3): 194-202. <http://www.iaeme.com/IJEET/issues.asp?JType=IJEET&VType=11&IType=3>

[30] Datta SC (2020) Artificial-Nest Rainwater-Harvesting with Fishery and Floating-or-Rooftop-Gardening Act as 21st Century COVID-19 Epidemic-Model: Improved Biodiversity Agriculture Socio-Economic Civil-Engineering Environmental-Sciences Technology-Communication. J Civil Eng Environ Sci 6(2): 022-036. Doi: <https://dx.doi.org/10.17352/2455-488X.000037>

[31] Deady M, Wales NS, Tan L, Wales NS, Collins D, Wales NS, et al. Unemployment, suicide, and COVID-19 : Using the evidence to plan for prevention. The Medical Journal of Australia. 2020;(June):1–8

[32] De-la-Torre, G.E., Aragaw, T.A., 2020. What we need to know about PPE associated with the COVID-19 pandemic in the marine environment. Mar. Pollut. Bull. 111879. <https://doi.org/10.1016/j.marpolbul.2020.111879>.

[33] Duan, H., Wang, S., and Yang, C. (2020). Coronavirus: Limit short-term economic damage. Nature, 578(7796), 515.

[34] Dw.com 2020. The coronavirus crisis has hit tourism in Malaysia hard. <https://www.dw.com/en/the-coronavirus-crisis-has-hit-tourism-in-malaysia-hard/a-53392776>.

[35] ECDPC. European Centre for Disease Prevention and Control, 2021. COVID-19 situation updates worldwide [WWW Document]. URL <https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases>.

[36] Economist. (2020). Still made in China. How to reopen factories after Covid-19. Economist, April 8th, 2020.

[37] EQUAL. European Commission Questions and Answers. 2020. EU Biodiversity Strategy for 2030-Bringing Nature Back into Our Lives. Available online from

https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_886. Accessed on 22 June 2021.

[38] Eriksen, M.; Lebreton, L. C. M.; Carson, H. S.; Thiel, M.; Moore, C. J.; Borrero, J. C.; Galgani, F.; Ryan, P. G.; Reisser, J. Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea. *PLoS One* 2014, 9 (12), e111913. <https://doi.org/10.1371/journal.pone.0111913>.

[39] Europe, P. Plastics - the Facts 2019 <https://www.plasticseurope.org/en/resources/market-data>.

[40] Everaert, G., De Rijcke, M., Lonneville, B., Janssen, C.R., Backhaus, T., Mees, J., van Sebille, E., Koelmans, A.A., Catarino, A.I., Vandegehuchte, M.B., 2020. Risks of floating microplastic in the global ocean. *Environ. Pollut.* 267, 115499. <https://doi.org/10.1016/j.envpol.2020.115499>.

[41] Ezeh CU, Ragatoa DS, Sanou CL and Emeribe CN. 2020. A review of the Impacts of COVID-19: Lessons for Africa, *Parana Journal of Science and Education*. 6(4):65-70. <https://doi.org/10.5281/zenodo.3880565>

[42] Fadare, O.O., Okoffo, E.D., 2020. Covid-19 face masks: a potential source of microplastic fibers in the environment. *Sci. Total Environ.* 737, 140279. <https://doi.org/10.1016/j.scitotenv.2020.140279>.

[43] Girdhar A, Kapur H, Kumar V, Kaur M, Singh D, Damasevicius R. 2020. Effect of COVID-19 outbreak on urban health and environment. *Air Quality, Atmosphere and Health*, 14(3): <https://doi.org/10.1007/s11869-020-00944-1>

[44] Gupta A, Zhu H, Doan MK, Michuda A, and Majumder B. 2020. Economic Impacts of The Covid-19 Lockdown in A Remittance-Dependent Region. *Amer. J. Agr. Econ.* 00(00): 1–20; doi:10.1111/ajae.12178.

[45] Hader, D. P., Banaszak, A. T., Villafane, V. E., Narvarte, M. A., Gonzalez, R. A., and Helbling, E. W. (2020). Anthropogenic pollution of aquatic ecosystems: emerging problems with global implications. *Science of the Total Environment*, 713, 136586.

[46] Horaire MA. 2021. Impact of COVID-19 Pandemic on Tourism Industry: Possible Reconciliation Strategy for Bangladeshi Tourism Industry. *International Tourism and Hospitality Journal* 4(4): 1-17.

[47] Hsu YC, Liu YA, Lin MH, Lee HW, Chen TJ, Chou LF, et al. Visiting policies of hospice wards during the COVID-19 pandemic: an environmental scan in Taiwan. *Int J Environ Res Public Health* 2020; 17:2857. Doi: <http://dx.doi.org/10.3390/ijerph17082857>.

[48] Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., et al. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*, 395, 497–506.

[49] ICR. Institute of Epidemiology Disease Control and Research". 2020. <https://www.iedcr.gov.bd>., Accessed June 20.

[50] ICR. Institute of Epidemiology Disease Control and Research". 2020. <https://www.iedcr.gov.bd>., Accessed June 20.

[51] ILO (2020) ‘COVID-19: Stimulating the economy and employment’. Available at https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_743036/lang--en/index.htm

[52] International Labor Organization. (2020). How will COVID-19 affect the world of work? <https://www.ilo.org/global/topics/coronavirus/lang--en/index.htm>

[53] Irish Water, 2020. Water conservation order ‘increasingly likely’ as demand for water soars and drought conditions prevail. Irish Water News. Available from: <HTTPS:// www.water.ie/news/water-conservation-order/>.

[54] Islam, S. M. D., Safiq, M. B., Bodrud-Doza, M., and Mamun, M. A. (2020). Perception and attitudes towards PPE-related waste disposal amid COVID-19 in Bangladesh: An exploratory study. *Frontiers in Public Health*. <https://doi.org/10.3389/fpubh.2020.592345>.

[55] JUST. The Johns Hopkins University School of Medicine. Coronavirus Resource Center USA: The Johns Hopkins University 2020. Available at: <https://coronavirus.jhu.edu/map.html>. (Accessed: 20th March 2021).

[56] Kampf G, Scheithauer S, Lemmen S, Saliou P, Suchomel M. COVID-19-associated shortage of alcohol-based hand rubs, face masks, medical gloves, and gowns — proposal for a risk-adapted approach to ensure patient and healthcare worker safety. *J Hosp Infect* 2020; 105:424–7. Doi: <http://dx.doi.org/10.1016/j.jhin.2020.04.041>.

[57] Kampf G, Todt D, Pfaender S, et al. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. *J Hosp Infect* 2020; 104:246e51.

[58] Kerimray, A., Baimatova, N., Ibragimova, O. P., Bukenov, B., Kenessov, B., Plotitsyn, P., et al. (2020). Assessing air quality changes in large cities during covid-19 lockdowns: The impacts of traffic-free urban conditions in Almaty, Kazakhstan. *Science of the Total Environment*, 139179.

[59] Khan A. U., Proma A. A., Akter M., Rahaman, M. M. and Das S. “A Review on Coronavirus Disease (COVID-19) Epidemic Threat for Global Health in 2020”. *American Journal of Microbiological Research*, 2020, Vol. 8, pp. 57–62, 2020. <https://doi.org/10.12691/ajmr-8-2-3>.

[60] Khan AU and Khan AU. 2020. The Impact of COVID-19 Pandemic Threat on Agriculture Sector. Proceeding of 8th International Conference of Biotechnology, Environment and Engineering Sciences 18 October 2020, Stockholm-Sweden. P. 15. Doi: 10.46617/icbe8.

[61] Khan AU, Akter R, Khan FU, Khanom S, Khan AU, Afsana AS. Second wave and pandemic situation of COVID-(2020-2021) in Bangladesh. *Qubahan Academic Journal*. 1(4): 25-31. Doi: <https://doi.org/10.48161/qaj.v1n4a74>

[62] Khan AU, Ema IJ, Afsana AS, Khan AU, Zannaty A, Faruk MF, and Rahman S. 2021. Effects of Coronavirus Disease (COVID-19) on Agricultural Sectors in Bangladesh: A Review. *International Journal for Asian Contemporary Research*. 1(1): 89-97. Available online from: <https://www.ijacr.net/upload/ijacr/2021-12-1012.pdf>

[63] Khan AU, Khan AU, and Afsana AS. (2021). Information about the COVID-19 in Bangladesh. International Conference on Social Sciences Business Management and Education. August 15, 2021, The Philippines. 2(1): 13.

[64] Khan AU, Khan FU, Khanom S, and Khan AU. 2020. Novel Coronavirus Disease (COVID-19): Pandemic Situation in Bangladesh. Nuj's Journal of Regulatory Studies. 5(2): 1-10.

[65] Khan AU, Khan FU, Khanom S, Khan AU, and Afsana AS. 2020. COVID-19 Pandemic Situation in Bangladesh. International Conference on Multidisciplinary Industry and Academic Research (ICMIAR). Candelaria, Quezon, Philippines. December 12, 2020. 1(1): 25. www.iilar.org

[66] Khan AU, Proma AA, Akter M, Rahaman MM, and Das S. 2020. A Review on Coronavirus Disease (COVID-19) Epidemic Threat for Global Health in 2020. American Journal of Microbiological Research. 8(2): 57-62. Available from: Doi: 10.12691/ajmr-8-2-3.

[67] Khan MAA, and Hashim H. 2020. The Effect of COVID-19 on Tourism and Hospitality Industry in Malaysia, Resurgence in the Post-Pandemic Era: A Conceptual Criterion. International Journal of Tourism and Hospitality Review 7(2):54-62. <https://doi.org/10.18510/ijthr.2020.726>

[68] Khan, A. U. (2021). Information about the covid-19 in Bangladesh (March 2020 to February 2021). In_Bangladesh_March_2020_To_February_2021. [Online]. Available from: https://www.researchgate.net/publication/351151990_Information_About_The_Covid-19.

[69] Kiessling, T., Gutow, L., Thiel, M., 2015. Marine litter as habitat and dispersal vector, in Marine Anthropogenic Litter. Springer International Publishing, pp. 141–181. DOI: https://doi.org/10.1007/978-3-319-16510-3_6.

[70] Kikuchi S, Kitao S, and Mikoshiba M. 2020. Who Suffers from the COVID-19 Shocks? Labor Market Heterogeneity and Welfare Consequences in Japan. CARE.: 1-40. <https://www.carf.e.u-tokyo.ac.jp/research/>

[71] Kim-Deobald, J.; Kozarek, R. A.; Ball, T. J.; Patterson, D. J.; Brandabur, J. J.; Raetz, S. Prospective Evaluation of Costs of Disposable Accessories in Diagnostic and Therapeutic ERCP. Gastrointest. Endosc. 1993, 39 (6), 763–765. [https://doi.org/10.1016/S0016-5107\(93\)70260-6](https://doi.org/10.1016/S0016-5107(93)70260-6).

[72] Lebreton, L. C. M.; van der Zwet, J.; Damsteeg, J.-W.; Slat, B.; Andrade, A.; Reisser, J. River Plastic Emissions to the World's Oceans. Nat. Commun. 2017, 8 (1), 15611. <https://doi.org/10.1038/ncomms15611>.

[73] Leung NHL, Chu DKW, Shiu EYC, Chan KH, McDevitt JJ, Hau BJP, YenHJ, Li Y, Ip DKM, Peiris JSM, Seto WH, Leung GM, Milton DK, and Cowling BJ. 2020. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nature Medicine. 26(May): 676–680. <https://doi.org/10.1038/s41591-020-0843-2>

[74] Loa SH, Lina CY, Hung CT, Hed JJ, Lu PL. 2021. The impact of universal face masking and enhanced hand hygiene for COVID-19 disease prevention on the incidence of hospital-acquired infections in a Taiwanese hospital. International Journal of Infectious Diseases. 104: 15–18.

<https://doi.org/10.1016/j.ijid.2020.12.072>

[75] Lodder W and de Roda Husman AM (2020) SARS-CoV-2 in wastewater: potential health risk, but also data source. *The Lancet Gastroenterology and Hepatology* 5(6): 533–534, [https://doi.org/10.1016/S2468-1253\(20\)30087-X](https://doi.org/10.1016/S2468-1253(20)30087-X).

[76] Lu H., Stratton C. W., and Tang Y. W. “Outbreak of Pneumonia of Unknown Etiology in Wuhan China: The Mystery and the Miracle”. *Journal of Medical Virology*, Vol. 92, pp. 401-402, 2020. Available from Doi:10.1002/jmv.25678.

[77] McIntyre RS, Lee Y. Preventing suicide in the context of the COVID-19 pandemic. *World Psychiatry*. 2020;19(2):250-1.

[78] McIntyre RS, Lee Y. Projected increases in suicide in Canada as a consequence of COVID-19. *Psychiatry Research*. 2020; 290:113104.

[79] Medema G, Heijnen L, Elsinga G and Italiaander R (2020) Presence of SARS-Coronavirus-2 in sewage. medRxiv, <https://doi.org/10.1101/2020.03.29.20045880>.

[80] Meyer, J., McDowell, C., Lansing, J., Brower, C., Smith, L., Tully, M., and Herring, M. (2020). Changes in Physical Activity and Sedentary Behavior in Response to COVID- 19 and Their Associations with Mental Health in 3052 US Adults. *International Journal of Environmental Research and Public Health*, 17(18), 6469. <http://dx.doi.org/10.3390/ijerph17186469>

[81] OECD (2020). A framework to guide an education response to the COVID-19 Pandemic of 2020. Paris: OECD Publishing.

[82] Orlik, Tom, Jamie Rush, Maeva Cousin, and Jinshan Hong. 2020. “Coronavirus Could Cost the Global Economy \$2.7 Trillion. Here’s How.” Bloomberg, 2020.

[83] Otu A, Effa E, Umoh V, Maxwell N, Ekpenyong A. Private sector initiatives to tackle the burden of covid-19: Experiences from the Nigerian frontline. *Pan African Medical Journal*. 2021; 38(March). Doi: 10.11604/pamj.2021.38.233.24634

[84] Paleologos EK, O’Kelly BC, Tang CS, et al. (2021) Post Covid-19 water and wastewater management to protect public health and geoenvironmental. *Environmental Geotechnics* 8(3):193–207, <https://doi.org/10.1680/jenge.20.00067>

[85] Paul, K. I., and Moser, K. (2009). Unemployment impairs mental health: Meta-analyses. *Journal of Vocational Behavior*, 74, 264–282.

[86] Peters A. (2020): The disorder of things: Quarantine unemployment, the decline of neoliberalism, and the Covid-19 lockdown crash, *Educational Philosophy and Theory*, Doi: 10.1080/00131857.2020.1759190

[87] Phelps Bondaroff, Teale, and Cooke, Sam. (2020, December). Masks on the Beach: The impact of COVID-19 on marine plastic pollution. *Oceans Asia*. Available at: COVID-19 Facemasks and Marine Plastic Pollution - OCEANS ASIA. (Accessed:13/2/ 2021).

[88] Prata JC, Silva AL, Walker TR et al (2020) COVID-19 Pandemic Repercussions on the Use and Management of Plastics. *Environ Sci Technol* 54:7760–7765. <https://doi.org/10.1021/acs.est.0c02178>

[89] Qin, F., Song, Y., Nassis, G. P., Zhao, L., Dong, Y., Zhao, C., Feng, Y., and Zhao, J. (2020). Physical Activity, Screen Time, and Emotional Well-Being during the 2019 Novel Coronavirus Outbreak in China. *International Journal of Environmental Research and Public Health*, 17(14), 5170. <http://dx.doi.org/10.3390/ijerph17145170>

[90] Reeves A, McKee M, Stuckler D. Economic suicides in the Great Recession in Europe and North America. *British Journal of Psychiatry*. 2014;205(3):246-7.

[91] Romero-Blanco, C., Rodríguez-Almagro, J., Onieva-Zafra, M. D., Parra- Fernández, M. L., Prado-Laguna, M. del C., and Hernández-Martínez, A. (2020). Physical Activity and Sedentary Lifestyle in University Students: Changes during Confinement Due to the COVID-19 Pandemic. *International Journal of Environmental Research and Public Health*, 17(18), 6567. <http://dx.doi.org/10.3390/ijerph17186567>

[92] Rume T, and Islam SMDU. 2020. Environmental effects of COVID-19 pandemic and potential strategies of sustainability. *Heliyon* 6 (June) e04965. <https://doi.org/10.1016/j.heliyon.2020.e04965>.

[93] Rumpler R, Venkataraman S, Goransson P. 2020. An observation of the impact of CoViD-19 recommendation measures monitored through urban noise levels in central Stockholm, Sweden. *Sustainable Cities and Society*. 63 (July): 102469. <https://doi.org/10.1016/j.scs.2020.102469>.

[94] Salisu, A. A. and Vinh Vo, X. (2020). Predicting stock returns in the presence of COVID-19 pandemic: The role of health news. *International Review of Financial Analysis*, 71:101546.

[95] Sañudo, B., Fennell, C., and Sánchez-Oliver, A. J. (2020). Objectively-Assessed Physical Activity, Sedentary Behavior, Smartphone Use, and Sleep Patterns Pre- and during- COVID-19 Quarantine in Young Adults from Spain. *Sustainability*, 12(15), 5890.

[96] Selim M, Aidrous I and Semenova E. 2020. International Tourism: Prospects for Development in The Post Coronavirus World (Egyptian Example). *International Journal of Management (IJM)*. 11(7): 1145-1155. Doi: 10.34218/IJM.11.7.2020.102

[97] Sharif, A., Aloui, C., and Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk, and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis*, 70:101496.

[98] Siciliano B, Carvalho G, da Silva CM, Arbillia G. The Impact of COVID-19 Partial Lockdown on Primary Pollutant Concentrations in the Atmosphere of Rio de Janeiro and São Paulo Megacities (Brazil). *Bull Environ Contam Toxicol* 105, 2–8 (2020). <https://doi.org/10.1007/s00128-020-02907-9>.

[99] Sifuentes, L.Y., Berba, C.P., Koenig, D.W., Phillips, R.L., Reynolds, K.A., 2014. Use of hygiene protocols to control the spread of viruses in a hotel. *Food and Environmental Virology* 6 (3), 175–181.

[100] Sims, J., 2020. Will the world be quieter after the pandemic? <https://www.bbc.com/future/article/20200616-will-the-world-be-quieter-after-the-pandemic>. (Accessed 14 July 2020).

[101] Sinha, A., Bernardes, E., Calderon, R., and Wuest, T. (2020). Digital Supply Networks: Transform Your Supply Chain and Gain Competitive Advantage with Disruptive Technology and Reimagined Processes. McGraw-Hill. ISBN-13: 978-1260458190

[102] Smart Water Magazine, 2020. World Bank supports Kosovo to address the national water crisis, highlighted by the COVID-19 pandemic. [Online]. Available. <HTTPS://smartwatermagazine.com/news/world-bank/world-bank-supports-kosovo-address-national-water-crisis-highlighted-covid-19> (Accessed 8 July 2021).

[103] Somani, M., Srivastava, A.N., Gummadiwalli, S.K., Sharma, A., 2020. Indirect implications of COVID-19 towards the sustainable environment: an investigation in the Indian context. *Biores. Technol. Rep.* 11, 100491.

[104] Suleř P, and Vrbka J. 2021. GDP Development of China and USA in terms of mutual sanctions and COVID-19. *Globalization and its Socio-Economic Consequences 2020. SHS Web of Conferences* 92, 07061. <https://doi.org/10.1051/shsconf/20219207061>

[105] Svabova, L., Metzker, Z., Tomasz, P. (2020). Development of unemployment in Slovakia in the context of the COVID-19 pandemic, *Ekonomicko-managers Spektrum*, 14(2), 114-123.

[106] Thompson, M. N., and Dahling, J. J. (2019). Employment and poverty: Why work matters in understanding poverty. *American Psychologist*, 74(6), 673-684. <https://doi.org/10.1037/amp0000468>

[107] Torres FG, De-la-Torre GE. Face mask waste generation and management during the COVID-19 pandemic: An overview and the Peruvian case. *Science of the Total Environment* 786 (2021) 147628. <https://doi.org/10.1016/j.scitotenv.2021.147628>

[108] Tinggui Chen, Lijuan Peng, Xiaohua Yin, Jingtao Rong, Jianjun Yang and Guodong Cong. 2020. “Analysis of User Satisfaction with Online Education Platforms in China during the COVID-19 Pandemic. *Healthcare*, 8(200): 2-26. Doi:10.3390/healthcare8030200.

[109] Tobías, A., Carnerero, C., Reche, C., Massagué, J., Via, M., Minguillón, M. C., et al. (2020). Changes in air quality during the lockdown in Barcelona (Spain) one month into the sars-Nov-2 epidemic. *Science of the Total Environment*, 138540.

[110] UfM, 2020. Mediterranean countries share water emergency and recovery plans to tackle the aftermath of COVID-19. Union for the Mediterranean Water and Environment. Available: <https://ufmsecretariat.org/mediterranean-countries-share-water-emergency-and-recovery-plans-to-tackle-the-aftermath-of-covid-19/> (Accessed 12 July 2021).

[111] UNESCO (2020, March 27). Teacher Task Force calls to support 63 million teachers touched by the COVID-19 crisis. UNESCO. Retrieved from <https://en.unesco.org/news/teacher-task-force-calls-support-63-million-teachers-touched-covid-19-crisis>.

[112] UNWTO. (2020). Impact assessment or COVID -19 outbreak on international tourism. Available online: <https://www.unwto.org/tourism-covid-19>.

[113] UNWTO. 2018. <https://luxe.digital/business/digital-luxury-reports/affluent-chinese-tourists/TEO> (Thailand Economic Outlook). 2021. Available online from <https://www2.deloitte.com/content/dam/Deloitte/th/Documents/about-deloitte/th-about-economic-outlook-1h-2019.pdf>

[114] Villarrubia-Gómez, P.; Cornell, S. E.; Fabres, J. Marine Plastic Pollution as a Planetary Boundary Threat – The Drifting Piece in the Sustainability Puzzle. *Mar. Policy* 2018, 96, 213–220. [https://doi.org/https://doi.org/10.1016/j.marpol.2017.11.035](https://doi.org/10.1016/j.marpol.2017.11.035).

[115] Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M., Pruyn, A.T.H., 2019. Measuring perceived cleanliness in service environments: Scale development and validation. *International Journal of Hospitality Management* 83, 11–18.

[116] Wandner, Stephen A. and Christopher J. O’Leary. 2020. "An Unemployment Insurance COVID-19 Crisis Response." *Employment Research* 27(2): 3-4. [https://doi.org/10.17848/1075-8445.27\(2\)-2](https://doi.org/10.17848/1075-8445.27(2)-2)

[117] Wang CJ, Ng CY, Brook RH. Response to COVID-19 in Taiwan: big data analytics, new technology, and proactive testing. *JAMA* 2020; 323:1341–2. Doi: <http://dx.doi.org/10.1001/jama.2020.3151>.

[118] WHO. World Health Organization, Bangladesh. https://www.who.int/docs/default-source/searo/bangladesh/covid-19-whobangladesh-situation-reports/who-covid-19-update-33-20201012.pdf?sfvrsn=8e5f58c7_2. Accessed October 14, 2020

[119] Winck, B. (2020, April 17). IMF chief says its forecast that 170 global economies will shrink may be too optimistic. *Business Insider*. <https://www.businessinsider.com/economic-outlook-imf-global-gdp-shrinkage-coronavirus-too-optimistic-says-2020-4?r=US&IR=T>

[120] Woo P. C., Huang Y., Lau S. K. S., and Yuen K. Y. "Coronavirus genomics and bioinformatics analysis". *Viruses*, Vol. 2, pp. 1804-1820, 2010. Available from: Doi: 10.3390/v2081803.

[121] World Bank (2020). Global Economic Prospects, June 2020. World Bank, Washington, DC.

[122] World Bank. (2020a). COVID-19 crisis through a migration lens. Migration and Development Brief 32. https://www.knomad.org/sites/default/files/202006/R8_Migrationpercent26Remittances_brief32.pdf

[123] World Bank. (2021). World development indicators. World Bank. <http://data.worldbank.org/data-catalog/world-development-indicators>

[124] WHO. World Health Organization. Coronavirus (COVID-19) events as they happen, 2020. Available from: <https://www.who.int/emergencies/diseases/novelcoronavirus-2019/events-as-they-happen>.

[125] WHO. 2020. Air pollution. <https://www.who.int/health-topics/air-pollution#tab=tab1>. Accessed 06/10/2020

[126] World Wildlife Fund, (2020). In the disposal of masks and gloves, responsibility is required. Available at: www.wwf.it/scuole/?53500%2FNello-smaltimento-di-mascherinee-guanti-servizi-responsabilita ([in Italian]. Accessed at: 13/2/2021).

[127] Worldometer. 2021. COVID-19 update. <https://www.worldometers.info/coronavirus/>

[128] Worldometer. Countries Where COVID-19 Has Spread. Coronavirus. 2021. Available online: <https://www.worldometers.info/coronavirus/countries-where-coronavirus-has-spread/>

[129] Worldometer. Countries Where COVID-19 Has Spread. Coronavirus. 2021. Available online: <https://www.worldometers.info/coronavirus/countries-where-coronavirus-has-spread/> (accessed on 12 December 2020).

[130] Wu F, Xiao A, Zhang J, et al. (2020) SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases. medRxiv, <https://doi.org/10.1101/2020.04.05.20051540>.

[131] Yamada E, Shimizutani S, Murakami E. 2020. The COVID-19 pandemic, remittances, and financial inclusion in the Philippines. *The Philippine Review of Economics* 57(1): 18-41. Doi: 10.37907/2ERP2020J

[132] Yu J, Seo J, and Hyun SS. 2021. Perceived hygiene attributes in the hotel industry: customer retention amid the COVID-19 crisis. *International Journal of Hospitality Management*. 93: 102768.

[133] Zambrano-Monserrate, M.A., Ruanob, M.A., Sanchez-Alcalde, L., 2020. Indirect effects of COVID-19 on the environment. *Sci. Total Environ.* 728, 138813.